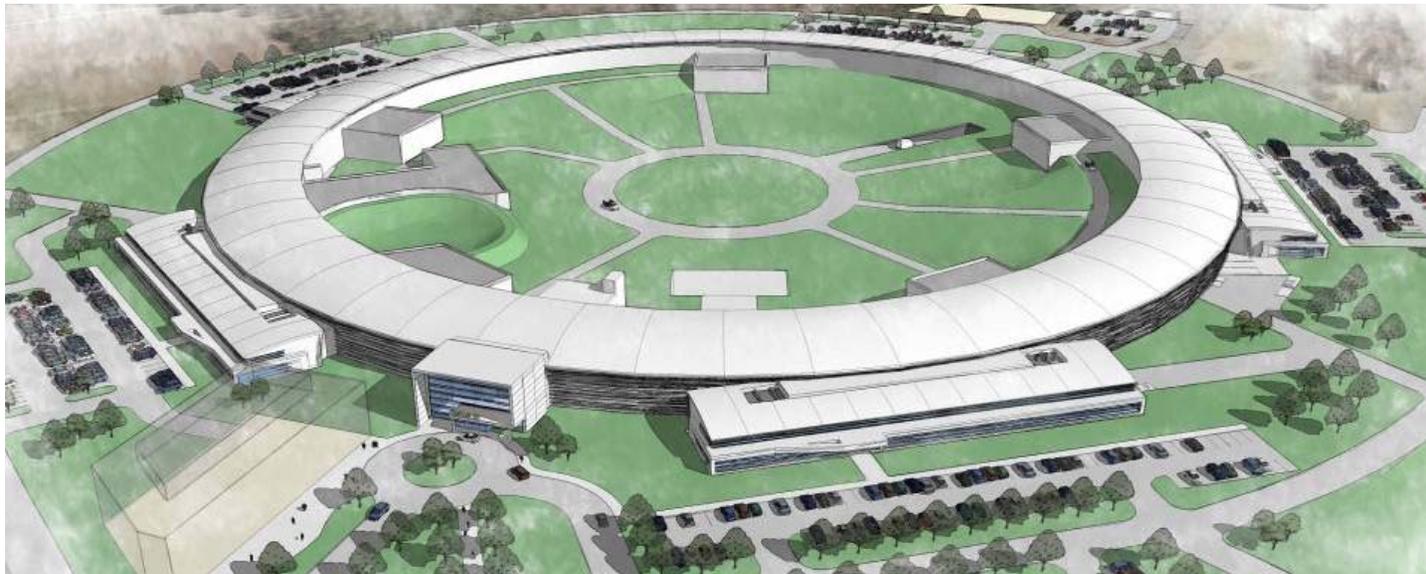


Experimental Facilities Division Overview



J. Hill, Division Director
EFAC October 4th 2007

Charge to EFAC

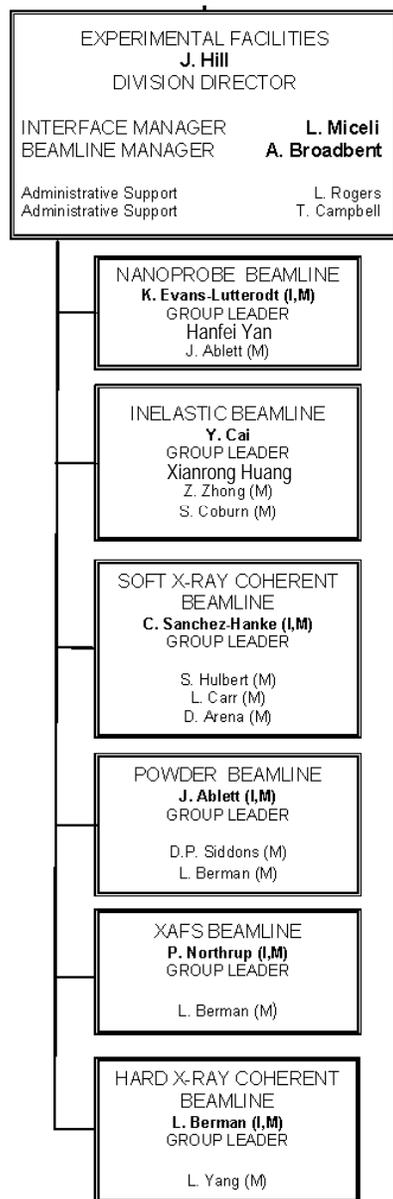
- BAT process:
 - Is there enough definition in the proposed Letter of Intent (LOI) to make informed decisions on the project (and other) beamlines?
 - Is the LOI and BAT process appropriate? Is the proposed schedule realistic?
- Are the compromises made to fit within the total budget appropriate?
- Are the designs for the project beamlines adequate to meet the stated scientific needs?
- Are the scope, WBS and functional requirements sufficiently well defined to establish the performance baseline for CD-2?
- Are the cost estimates sufficiently well defined to provide confidence in them?
- Is the resource loaded schedule of sufficient definition, and with the appropriate logic ties, to provide confidence in the baseline?

Experimental Facilities Division

Responsible for:

- All phases of specification, design, procurement, installation and commissioning of the suite of beamlines and instruments included in the project scope.
- Planning for subsequent beamline development
- Interaction with User Community
- R+D program to support Division needs.

XFD Organization



Hires made since last EFAC:

A. Broadbent (Beamline Mgr)
 Y. Cai (IXS Group Leader)
 X. Huang (0.1 meV R+D)
 L. Miceli (Interface Mgr)
 H. Yan (1 nm R+D)

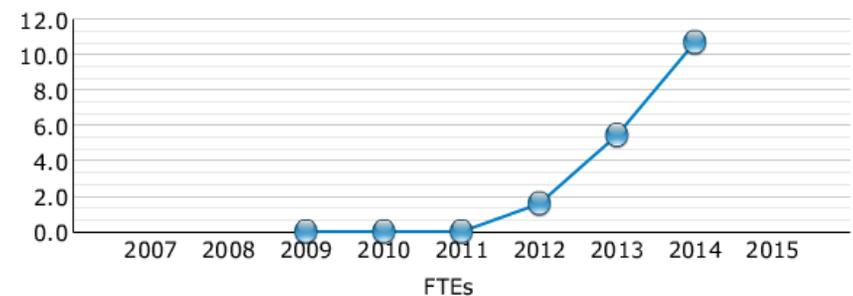
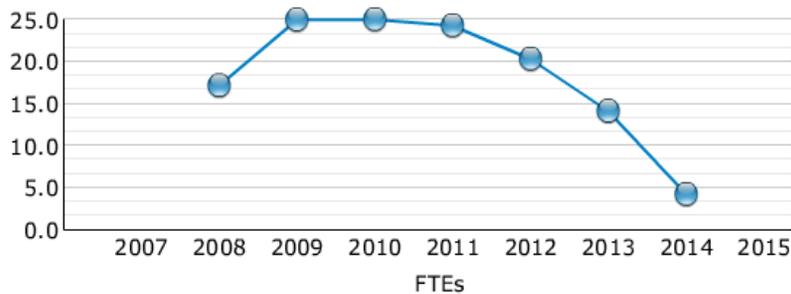
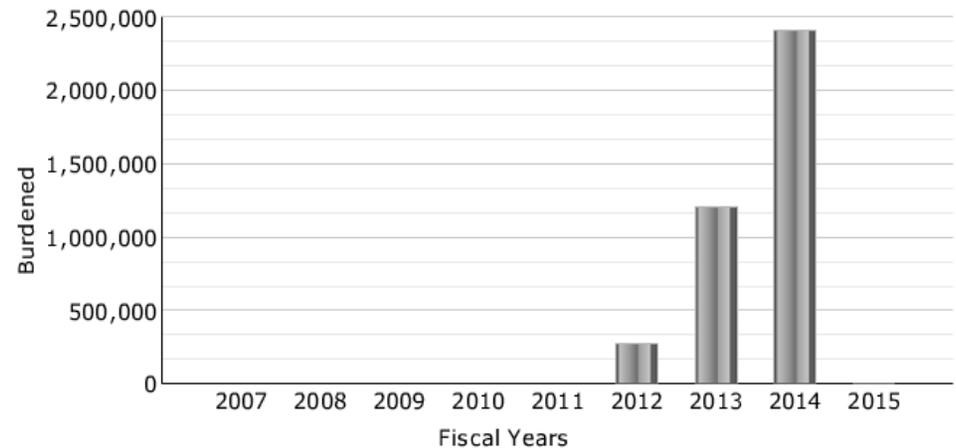
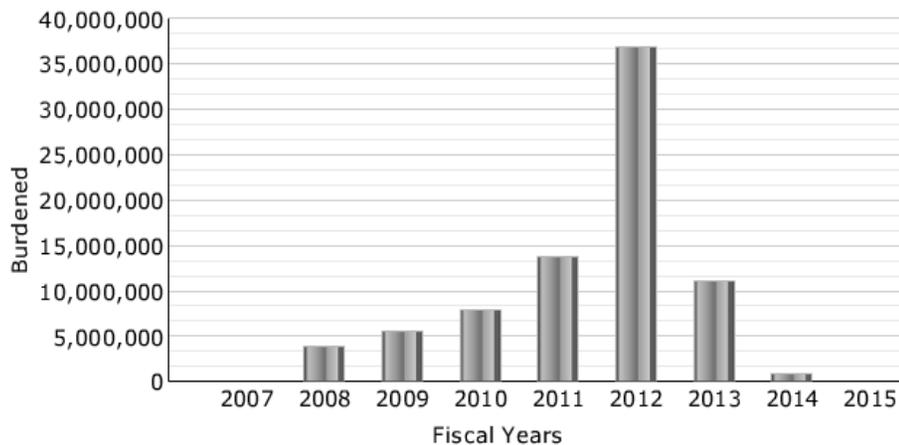
Currently Interviewing for:

Nanoprobe Group Leader
 Deposition Scientist
 Hard Coherent Group Leader
 Soft Coherent Group Leader
 XAS Group Leader
 Powder Group Leader

Current Cost and FTE Profile

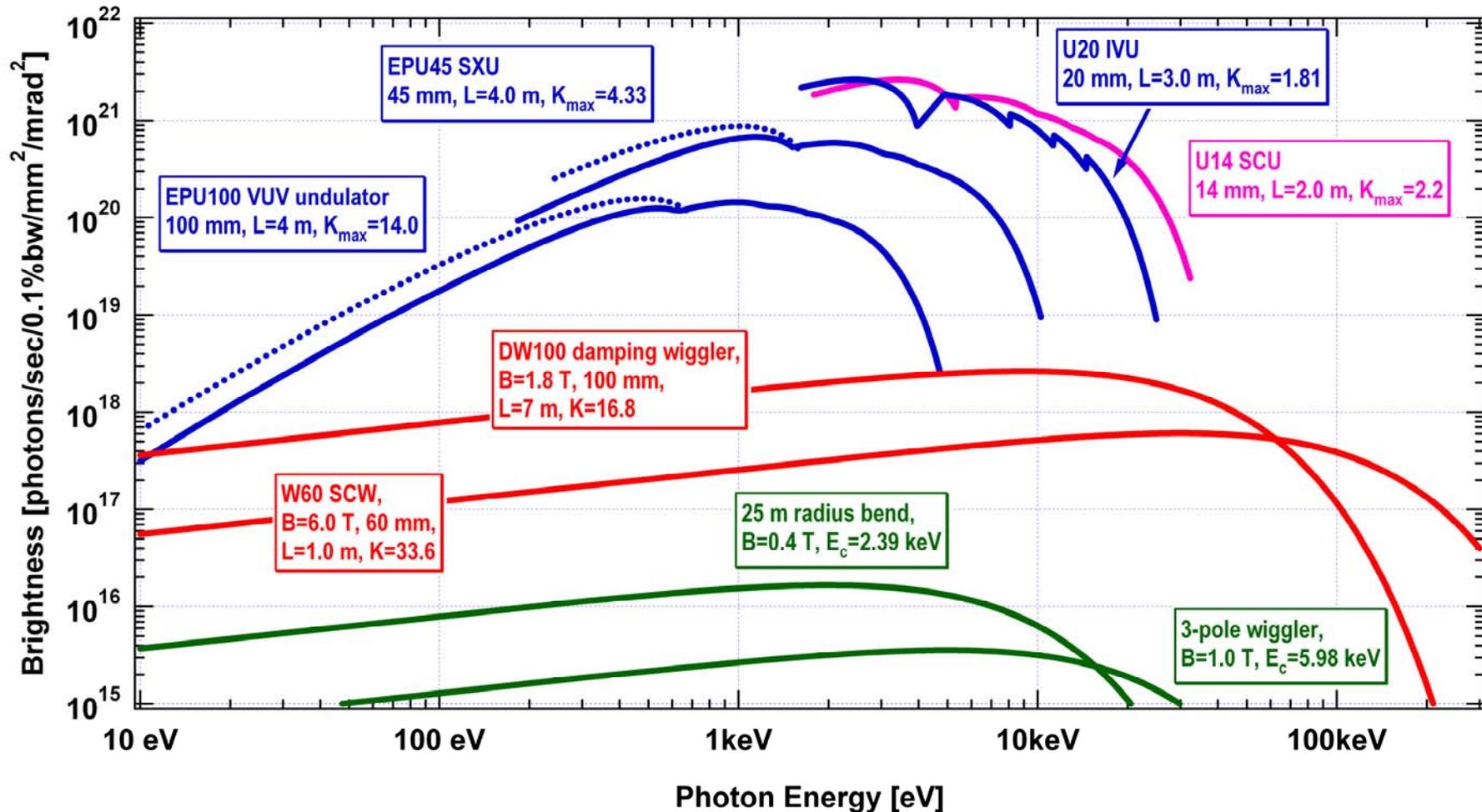
Experimental Facilities 1.04 \$80 M

Pre-ops 1.06.03 \$6 M

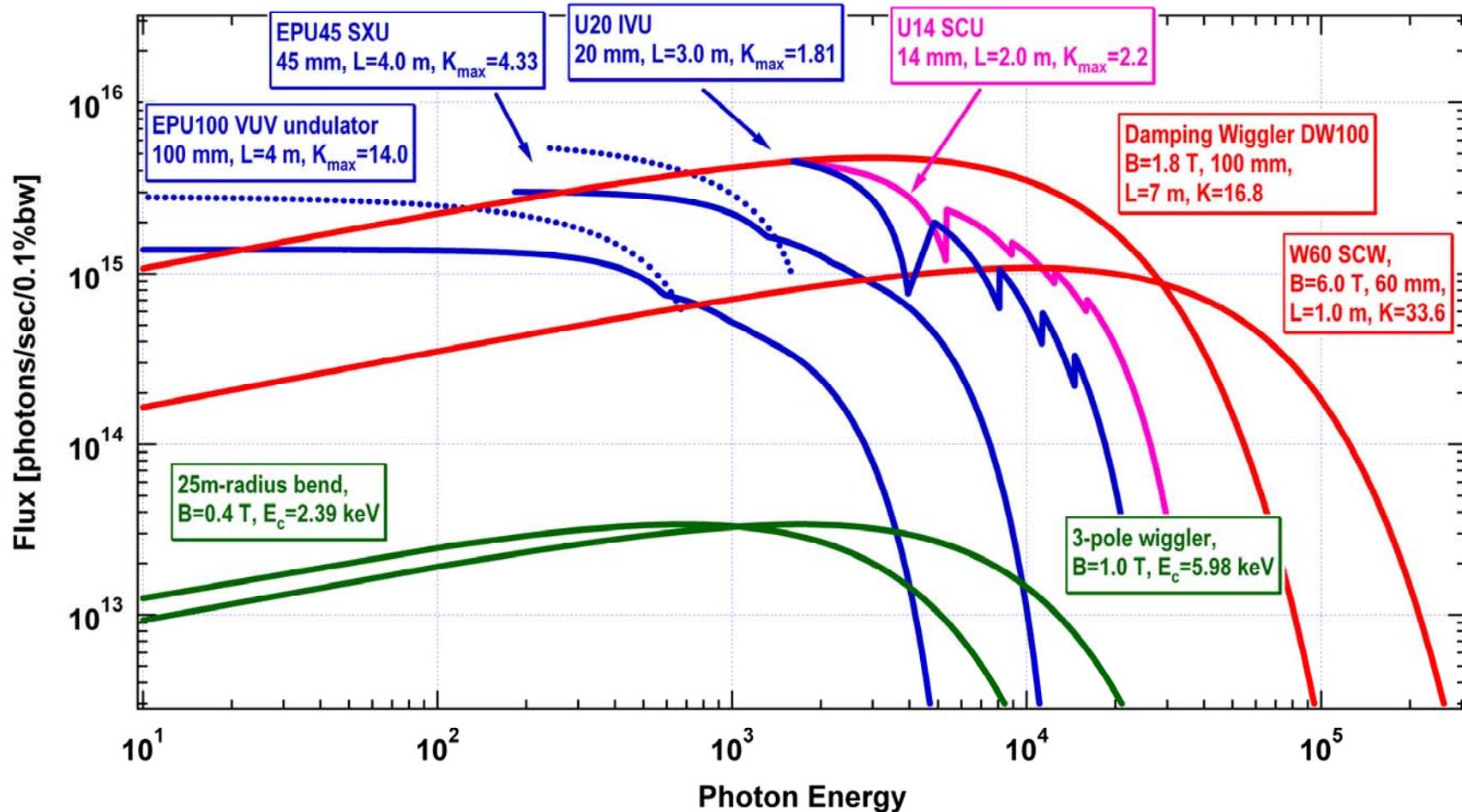


N.B. Costs are burdened and escalated

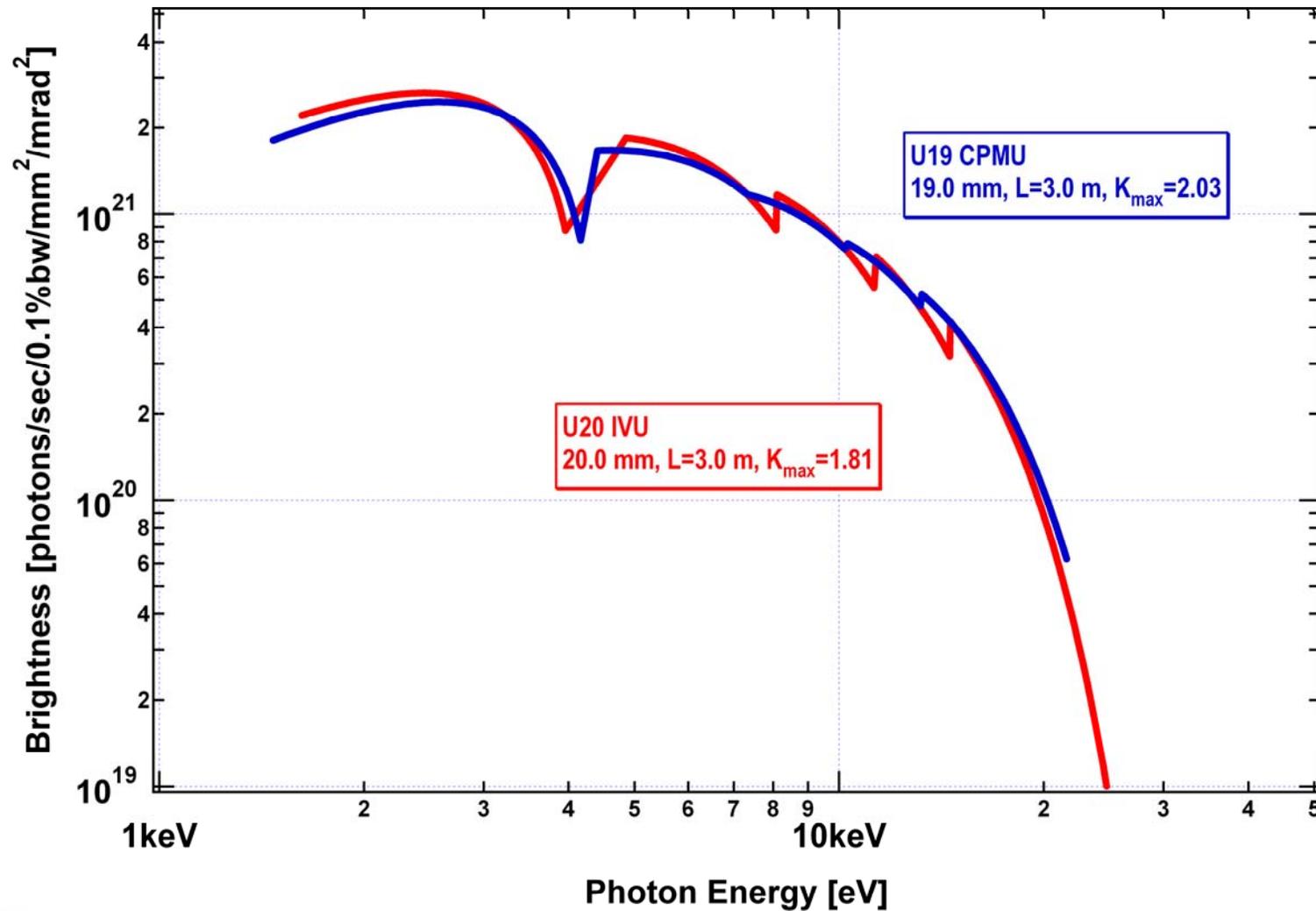
Radiation Sources: Brightness



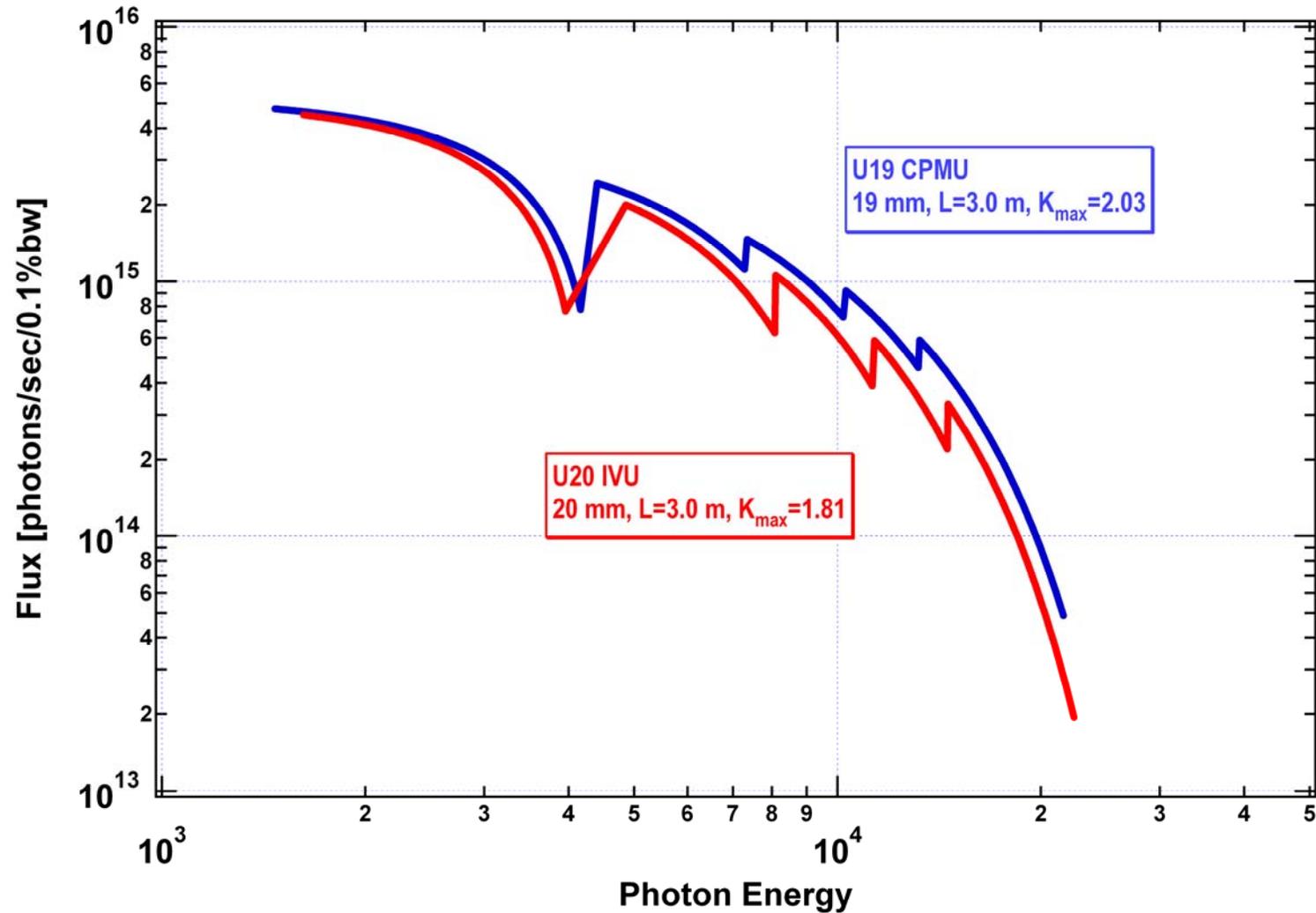
Radiation Sources: Flux



Comparison of CPMU vs R.T. IVU

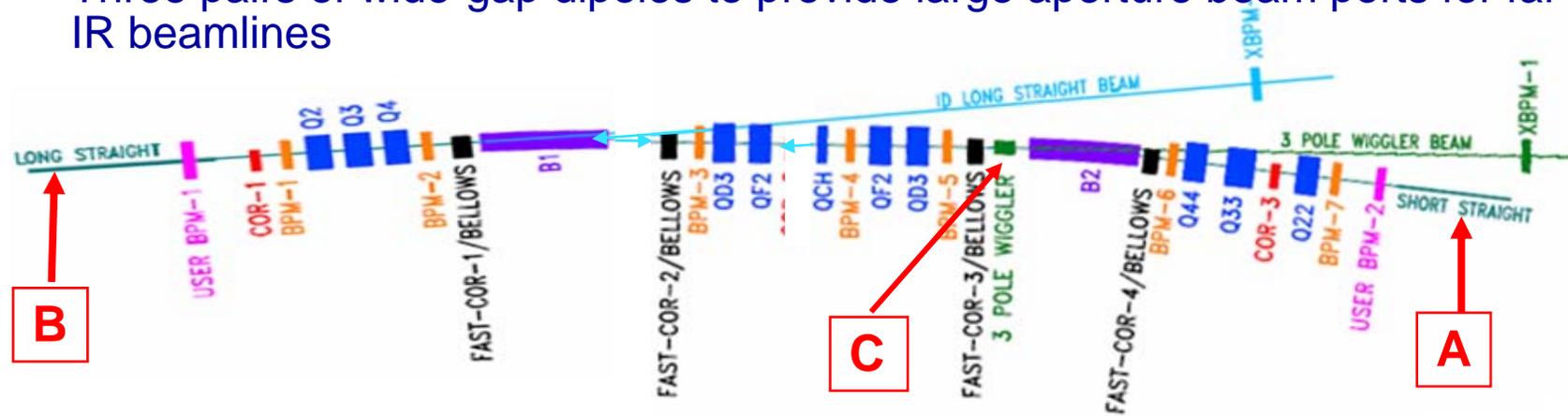


Comparison of CPMU vs R.T. IVU



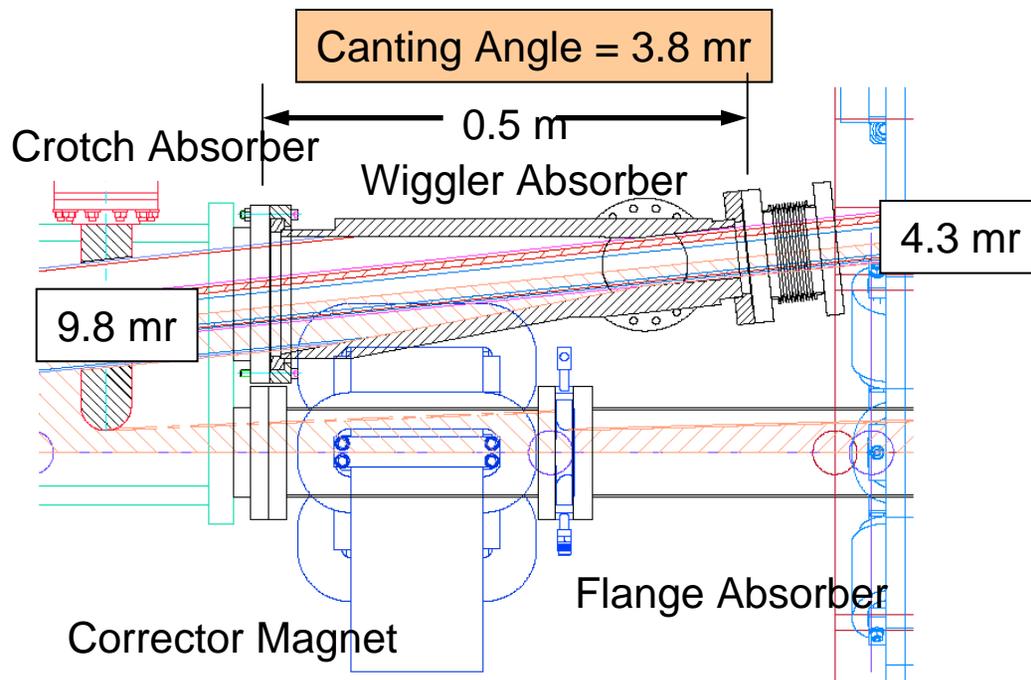
Diverse Beamlines from NSLS-II

- A. Short ID straights (low β): high brightness hard X-rays beamlines
 - CPMU for ultra-bright hard x-ray beamlines
 - EPU for polarized x-ray beamlines
- B. Long ID straights: damping wigglers and their high power beamlines and other insertion devices
 - Study in progress for canted DW's to generate two beamlines from 1 straight
- C. Three-Pole Wiggler (TPW) in dispersion straights for hard x-ray beamlines, similar in flux as NSLS dipole radiation but ~ 100 times brighter (< 15)
- D. Soft bend dipoles for soft x-ray and UV beamlines
- E. Three pairs of wide-gap dipoles to provide large aperture beam ports for far IR beamlines



Canting of Damping Wigglers

- 7 m DW can be split into two ~ 3 m wigglers with canting magnets in between
- With special design of the magnets near the front-end, the DW absorber system can be modified to handle the radiation with a total fan angle of 9.8 mrad
- This will allow 3.8 mrad canting of two 100 mm period DW's (~ 3 m long) with ± 3 mrad fan, providing a complete separation of two beams



- Impact of 3.8 mrad bend in the achromatic straight on the chromaticity, thus on the emittance control by wigglers must be evaluated, but should be small
- ± 0.25 mrad beam deviation from its nominal orbit and an additional ± 1 mm machining and alignment tolerance are allowed

Beamline Development

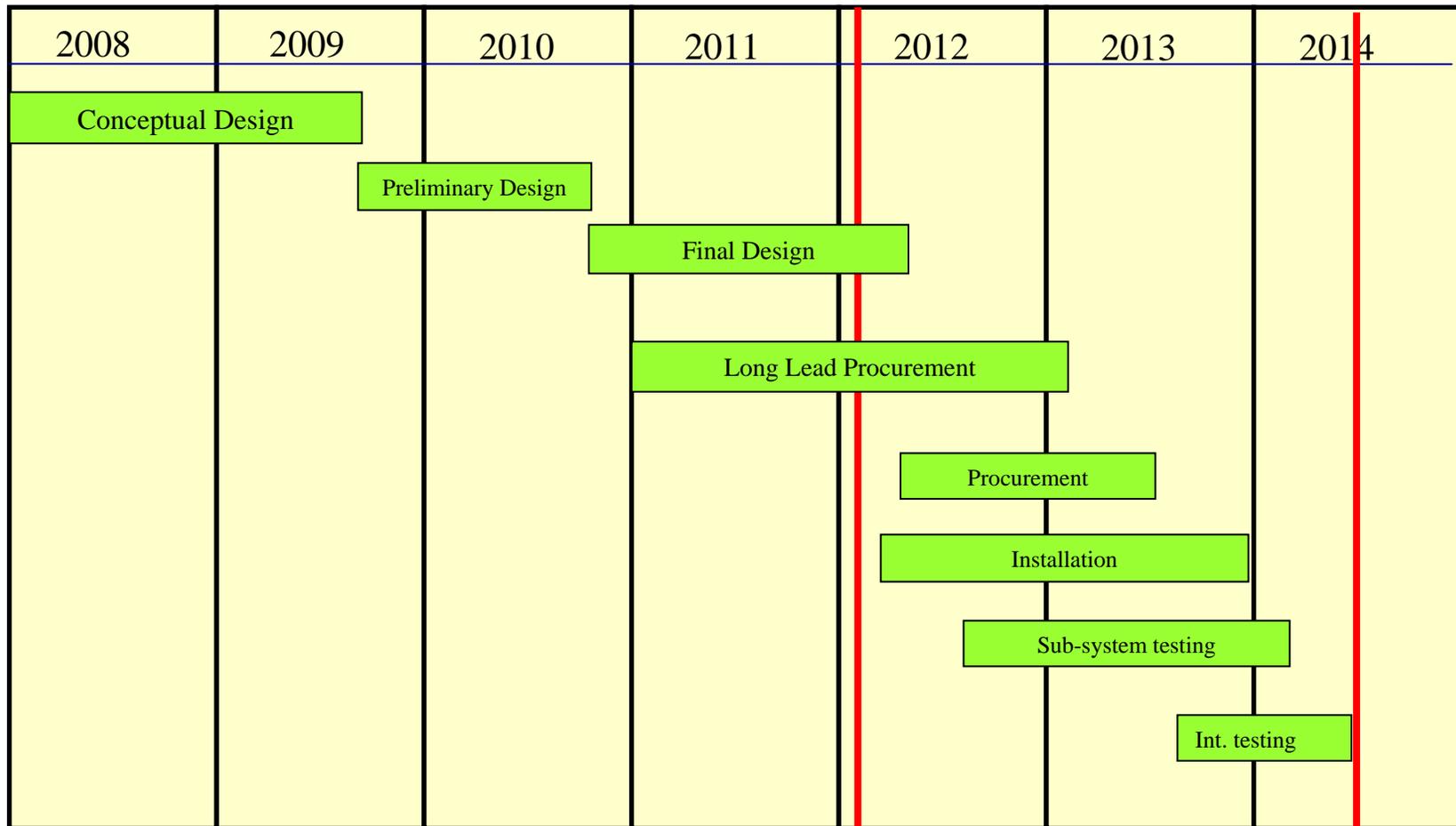
- 6 Insertion Device beamlines to be built as part of the construction project
- ~20 dipole beamlines to be moved over from existing NSLS, under NSLS-II early operations funding (FY12)
- Funding for ~15 BES-relevant insertion device beamlines to be pursued via separate Major Items of Equipment (MIEs) DOE-BES funding (CD-0 for first one in June 08)
- Non-BES relevant beamlines funded by other sources

Project Beamlines

Project goal: To provide a minimum suite of insertion device beamlines to meet physical science needs that both exploit the unique capabilities of the NSLS-II source and provide work horse instruments for large user capacity.

- The beamlines are:
 - Inelastic x-ray scattering (0.1 meV) U20 undulator
 - Nanoprobe (1 nm) U20 undulator
 - Soft x-ray coherent scattering and imaging EPU45 undulator
 - Hard x-ray coherent scattering and SAXS U20 undulator
 - Powder diffraction Damping wiggler
 - XAS Damping wiggler

Cartoon Schedule for Project Beamlines



Activity Name	Original Duration	Start	Finish	2008				2009				2010				2011				2012				2013				2014				2015			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1 NSLS-II Project	1673	01-Oct-07	11-Jun-14	[Gantt bar from 01-Oct-07 to 11-Jun-14]																															
1.04 Experimental Facilities	1673	01-Oct-07	11-Jun-14	[Gantt bar from 01-Oct-07 to 11-Jun-14]																															
1.04.01 Experimental Facilities Management	1673	01-Oct-07	11-Jun-14	[Gantt bar from 01-Oct-07 to 11-Jun-14]																															
Coordination of LOI Process	62	01-Oct-07	02-Jan-08	[Gantt bar from 01-Oct-07 to 02-Jan-08]																															
Determine Shielding Requirements	103	01-Oct-07	03-Mar-08	[Gantt bar from 01-Oct-07 to 03-Mar-08]																															
Conceptual Design of All Beamlines	494	01-Oct-07	21-Sep-09	[Gantt bar from 01-Oct-07 to 21-Sep-09]																															
Select BATS - Hold User Workshop	0		01-Oct-07	[Milestone diamond at 01-Oct-07]																															
Select BATS- First round LOIs due	0		29-Feb-08*	[Milestone diamond at 29-Feb-08]																															
Review LOI's and Submit to EFAC	62	29-Feb-08	27-May-08	[Gantt bar from 29-Feb-08 to 27-May-08]																															
Select Bats - EFAC makes BAT recommendation	0		31-Mar-08*	[Milestone diamond at 31-Mar-08]																															
Review of EFAC Recommendations	10	31-Mar-08	14-Apr-08	[Gantt bar from 31-Mar-08 to 14-Apr-08]																															
Select BATS - Decision on Project BATS	0		15-Apr-08*	[Milestone diamond at 15-Apr-08]																															
Conceptual Design, Project Beamlines-Hire lead scientist	0		27-Jun-08*	[Milestone diamond at 27-Jun-08]																															
Conceptual Design, Project Beamlines-Determine high level BL specifications	0		15-Oct-08*	[Milestone diamond at 15-Oct-08]																															
BAT Review of 50% Conceptual Design for All Beamlines	0		28-Jan-09*	[Milestone diamond at 28-Jan-09]																															
Technical and Safety Reviews of Conceptual Design	110	15-Apr-09	21-Sep-09	[Gantt bar from 15-Apr-09 to 21-Sep-09]																															
Conceptual Design, Project Beamlines- Write specifications for insertion devic	0		15-Jun-09*	[Milestone diamond at 15-Jun-09]																															
Conceptual design for All Beamlines complete	0		30-Sep-09*	[Milestone diamond at 30-Sep-09]																															
Preliminary Design of All Beamlines	249	30-Sep-09	28-Sep-10	[Gantt bar from 30-Sep-09 to 28-Sep-10]																															
Preliminary Design for WBC, HHO and BCO Complete	0		12-Mar-10	[Milestone diamond at 12-Mar-10]																															
BAT Review of 50% Preliminary Design for All Beamlines	0		16-Mar-10*	[Milestone diamond at 16-Mar-10]																															
Preliminary Design for End Stations 1 Complete	0		15-Jun-10	[Milestone diamond at 15-Jun-10]																															
Technical and Safety Reviews of Preliminary Design	22	17-Aug-10	17-Sep-10	[Gantt bar from 17-Aug-10 to 17-Sep-10]																															
Preliminary Design for Enclosures, Utilities & Beam Transport Complete	0		31-Aug-10	[Milestone diamond at 31-Aug-10]																															
Preliminary Design for All Beamlines Complete	0		28-Sep-10*	[Milestone diamond at 28-Sep-10]																															
Final Design of Beamline Major Components	132	28-Sep-10	11-Apr-11	[Gantt bar from 28-Sep-10 to 11-Apr-11]																															
Technical and Safety Reviews of LLP	22	28-Sep-10	29-Oct-10	[Gantt bar from 28-Sep-10 to 29-Oct-10]																															
Technical Design (Proj Beamlines)-Approval of long lead term procurement	0		29-Oct-10	[Milestone diamond at 29-Oct-10]																															
Final Design for Enclosures and Utilities Complete - Start LLP	0		10-Dec-10*	[Milestone diamond at 10-Dec-10]																															
Long Lead Time Procurements (Mirrors, Enclosures...) of Beamline 1	457	05-Jan-11	31-Oct-12	[Gantt bar from 05-Jan-11 to 31-Oct-12]																															
Completion of Final Design of All Beamlines	268	11-Apr-11	07-May-12	[Gantt bar from 11-Apr-11 to 07-May-12]																															
Final Design for WBC, HHO, BCOCComplete	0		11-Apr-11*	[Milestone diamond at 11-Apr-11]																															
BAT Review of 50% for Final Design of All Beamlines	0		13-Apr-11*	[Milestone diamond at 13-Apr-11]																															
Approval of start of construction	0		16-May-11*	[Milestone diamond at 16-May-11]																															
Final Design for End Station 1 and End Station 2 Complete	0		19-Oct-11*	[Milestone diamond at 19-Oct-11]																															
Installation	443	30-Mar-12	07-Jan-14	[Gantt bar from 30-Mar-12 to 07-Jan-14]																															
FDR Reviews	22	05-Apr-12	07-May-12	[Gantt bar from 05-Apr-12 to 07-May-12]																															
Procurement	352	01-May-12	26-Sep-13	[Gantt bar from 01-May-12 to 26-Sep-13]																															
Final Design of All Beamlines Complete	0		07-May-12*	[Milestone diamond at 07-May-12]																															
Sub-system Testing	435	01-Jun-12	03-Mar-14	[Gantt bar from 01-Jun-12 to 03-Mar-14]																															
ID Insertion Device for All Beamlines Installed and Tested	0		01-Feb-13*	[Milestone diamond at 01-Feb-13]																															
Integrated Testing	207	13-Aug-13	11-Jun-14	[Gantt bar from 13-Aug-13 to 11-Jun-14]																															
Safety and Readiness Review of Integrated Components	22	09-May-14	11-Jun-14	[Gantt bar from 09-May-14 to 11-Jun-14]																															
All Beamlines Available for Commissioning	0		11-Jun-14	[Milestone diamond at 11-Jun-14]																															

Project Beamline Design Process

- Begun with CDR (Dec '07)
<http://www.bnl.gov/nsls2/project/CDR/>
Written with contributions from internal and external scientists
- Project Beamlines selected (Feb '07)
- Breakout sessions held at User workshop (July '07)
<http://www.bnl.gov/nsls2/workshops/UserWorkshop.asp>
- Outside engineering firms contracted for more detailed conceptual design (July - Sept '07).
- Beamline specific user workshops to be held (by early '08)
- BATs selected for project beamlines (by spring '08)
- Design begun in earnest with active engagement of BAT and facility staff. ('08 to '12)

Beamline Cost Estimates

	IXS	Nano	H. Coh.	S. Coh	XAS	Powder	
Enclosures	\$ 1,150,960	\$ 1,489,445	\$ 1,583,317	\$ 174,598	\$ 1,212,499	\$ 1,472,787	\$ 7,083,606
Beam Transport	\$ 685,166	\$ 153,670	\$ 1,565,088	\$ 206,807	\$ 409,495	\$ 375,756	\$ 3,395,982
Utilities	\$ 335,616	\$ 505,074	\$ 316,364	\$ 227,774	\$ 227,668	\$ 227,668	\$ 1,840,164
High Heatload Optics	\$ 976,463	\$ 1,536,974			\$ 2,127,744	\$ 1,188,811	\$ 5,829,992
Beam Conditioning Optics	\$ 1,921,140	\$ 2,290,227	\$ 1,989,884		\$ 1,583,678	\$ 871,612	\$ 8,656,541
Personnel Safety System	\$ 183,352	\$ 187,537	\$ 278,181	\$ 96,894	\$ 183,352	\$ 183,352	\$ 1,112,668
Equipment Protection System	\$ 86,262	\$ 86,262	\$ 86,038	\$ 140,144	\$ 86,038	\$ 86,545	\$ 571,289
White Beam Apertures				\$ 262,817			\$ 262,817
White Beam Components		\$ 302,131	\$ 1,278,815				\$ 1,580,946
End Station 1	\$ 2,522,167	\$ 4,241,913	\$ 3,509,501	\$ 1,869,898	\$ 752,988	\$ 3,018,162	\$ 15,914,629
End Station 2			\$ 3,328,590		\$ 1,967,186		\$ 5,295,776
Beamline Controls	\$ 674,461	\$ 504,235	\$ 386,610	\$ 120,756	\$ 147,727	\$ 100,351	\$ 1,934,140
Beamline Control Station	\$ 35,686	\$ 35,686	\$ 35,686	\$ 35,686	\$ 38,902	\$ 35,686	\$ 217,332
Satellite Building		\$ 1,025,465	\$ 1,392,908				\$ 2,418,373
Beamline Management	\$ 1,368,930	\$ 1,574,258	\$ 1,529,692	\$ 1,261,295	\$ 1,462,293	\$ 1,624,346	\$ 8,820,814
Branching Mirror				\$ 598,408			\$ 598,408
Exit Slits				\$ 1,102,562			\$ 1,102,562
First Mirrors (m0 and M1)				\$ 1,111,344			\$ 1,111,344
Monochromator (m2 + gratings)				\$ 1,565,745			\$ 1,565,745
Polarization Selection Components				\$ 243,890			\$ 243,890
Refocusing Mirror				\$ 2,730,113			\$ 2,730,113
Specialized White Beam Comp					\$ 472,353	\$ 351,800	\$ 824,153
Grand Total	\$ 9,940,203	\$ 13,932,877	\$ 17,280,674	\$ 11,748,731	\$ 10,671,923	\$ 9,536,876	\$ 73,111,284

N.B. Costs are burdened and escalated

Scope & Cost Reductions

ID	Item	Priority to restore?	Estimated Bottom Line
XF-1	Remove 1 meV endstation from IXS beamline	High	\$ 2,772,650
XF-3	Reduce scope of hard coherent diffraction endstation	High	\$ 2,109,625
XF-2	Reduce budget for smart XPCS detector	Medium	\$ 602,750
XF-4	Remove 10 nm endstation from nanoprobe	Medium	\$ 303,786
XF-8	Remove second endstation for powder beamline	Medium	\$ 843,850
XF-6	Remove soft x-ray endstation (scattering)	Medium	\$ 783,575
XF-5	Remove sub 20 keV capability for powder beamline	Low	\$ 1,326,050
XF-7	Remove soft x-ray Mirror	Low	\$ 482,200
	XF Subtotal		\$ 9,224,486

N.B. In the event of good cost performance, we will attempt to restore these into the project.

Experimental Facilities Scope Contingency

ID	Item	Priority to keep?	Estimated Bottom Line
XF-1	Satellite building, nanoprobe beamline	High	\$ 1,084,950
XF-2	Satellite building, hard coherent beamline	Medium	\$ 1,487,962
XF-3	Hard coherent diffraction endstation	Medium	\$ 3,254,850
XF-4	XPCS endstation	Medium	\$ 3,495,950
XF-5	Soft coherent endstation	Medium	\$ 1,808,250
XF-6	XAS endstation	Medium	\$ 711,245
XF-7	Hi-res mono for XAS beamline	Medium	\$ 421,925
XF-8	Remove 2nd endstation enclosures (all beamlines)	Medium	\$ 1,808,250
	XF Subtotal		\$ 14,073,382

Major Areas of Risk

- Three beamlines require substantial R+D to achieve performance goals:
 - 0.1 meV energy resolution (funded from project)
 - 1 nm spatial resolution (funded from project)
 - Fast, pixelated detector for hard coherent beamline (outside project)
- Soft coherent beamline requires mirrors beyond state-of-the-art to achieve resolution goals
- Wiggler beamlines have heat-load issues (R+D planned for project).
- Cost risk associated with changes in scope.

XFD R+D Plan

There are several key goals for the R+D program:

- 0.1 meV energy resolution
- 1nm spatial resolution
 - Optics and positioning
- Beam position and intensity monitors for stability
- High-heat load optics

Summary

- Designs are currently being pursued for the 6 project beamlines based on experimental requirements for these techniques. These are documented in Preliminary Design Report (PDR) **Due Oct 19th**.
- Requirements and high-level specifications are in RSI documents. **Due Nov 2nd**
- There are technical and cost risks in achieving performance goals on all the project beamlines. These are being mitigated through R+D, alternate strategies and contingency.
- Organizational structure is in place to manage the design and construction of these beamlines. Active recruitment is underway.
- On track for a successful CD-2 review **Nov 6th-9th**